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Defense Economy of the United States Transportation and Power

BY JOHN C. deWILDE

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Defense Economy of the United States: Transportation and Power*

BY JOHN C. DEWILDE

THE functioning of our economic system and the success of our national defense program depend to a high degree on transportation and electric power. Without adequate transportation facilities we cannot mobilize the resources of this vast country on a national scale, keep materials flowing in an endless stream to factories, and distribute the resulting products to all corners of the land and to ports for export overseas. Without sufficient power many of the machines of industry would cease to hum, and homes, streets and factories would be darkened. The lack of certain raw materials or industrial facilities may create specific, localized bottlenecks in our defense economy; but a shortage of power or transport may retard munitions production all along the line.

In the last war this country suffered from local power shortages and our transportation system came perilously close to a complete breakdown. Until recently a repetition of these experiences appeared inconceivable. Utility companies had substantial generating capacity in reserve, railroads were still complaining about inadequate traffic and revenues, and the defense program seemed comparatively modest. Today, however, anticipated requirements have multiplied. More than $43,000,000,000 have been appropriated, authorized and recommended for national defense, and there is no assurance that even this sum will not have to be increased. The conversion of these billions into war material imposes heavy additional burdens in generating and transportation facilities. A power shortage has already appeared in the Southeast, and the Federal Power Commission has predicted that serious deficiencies will develop in 1943 unless orders for large amounts of additional capacity are placed immediately. At the same time, the government is becoming increasingly fearful that existing transportation agencies will be unable to cope with the prospective traffic load. The present report examines these potential bottlenecks in the country's economy and the measures taken to overcome them.

In contrast to the first World War, when motor vehicle traffic, pipe lines and aviation were only in their initial stages of development, we can today rely on five kinds of transportation. As the accompanying table shows, the railways now carry less than 9 per cent of the passengers and only a little more than 61 per cent of the freight. The proportion taken by non-railway agencies would be still larger if local, as distinct from inter-city, traffic on the highways were included, and if domestic coastwise and intercoastal trade were taken into account. The important part played by air transport in the national economy is due to the quality rather than the volume of its business.

PUBLIC AND PRIVATE INTERSTATE TRAFFIC BY KINDS OF TRANSPORTATION DURING 1939[1]

	Freight		*Passengers*	
Agency	Ton-miles (in millions)	Per cent of total	Passenger-miles (in millions)	Per cent of total
Railways	336,100	61.85	23,669	8.62
Highways[2]	46,000	8.47	248,859	90.59
Inland Waterways including Great Lakes	96,249	17.71	1,486	0.54
Pipe Lines	65,015	11.97	.....	.....
Air Carriers	11	.....[3]	678	0.25
TOTAL	543,375	100.00	274,692	100.00

1. *54th Annual Report of the Interstate Commerce Commission*, November 1, 1940, p. 23.
2. Private (i.e., not for hire) motor carriers accounted for half of the freight movement over highways, and private automobiles for 85.44 per cent of the passenger-miles.
3. Less than 0.01 per cent.

HIGHWAYS AND MOTOR CARRIERS

This country has become so dependent on motor traffic that serious economic dislocation would occur if a large proportion of automobiles and trucks were suddenly taken off the highways, as has happened in Europe. Factory shifts could not be assembled without cars, and a considerable percentage of farm products would not reach the market without trucks. About 48,000 communities,

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including 6.3 per cent of the country's population, are without railway service.[1]

In the period 1914 to 1938 our highway system increased from 2,446,000 to 3,000,000 miles, and the surfaced mileage from 257,300 to 1,100,000.[2] Despite this improvement, highway facilities still show many deficiencies. Although the federal government has helped to develop highways on a national pattern through its grants-in-aid inaugurated in 1916, the bulk of our roads have been planned and financed by state and local governments and are therefore not sufficiently integrated.[3] There are serious bottlenecks near population centers. Additional roads are needed to provide access to army and navy reservations and defense plants, and to meet the tactical needs of the Army. The War Plans Division of the Army General Staff has designated about 75,000 miles of main highways as a "strategic network." In this system stretches of weak road surfaces and narrow roadways must be improved, and 2,400 bridges must be brought up to the standard specified for the movement of heavy ordnance.[4] The President has asked Congress to authorize the expenditure of $100,000,000 to assist localities in the development of access roads, and of $25,000,000 to strengthen bridges and widen surfaces in key areas.[5]

The number of passenger cars registered in the United States rose from 2,310,000 in 1915 to about 27,300,000 in 1940, and the number of motor trucks from 326,000 in 1917 to more than 4,650,000 in 1940. The curtailment of motor-vehicle production by 20 per cent during the model year beginning August 1941 should not seriously affect essential passenger traffic. The output of trucks will not be reduced as much, since manufacturers making trucks exclusively have been cut only 5 to 10 per cent. Although the automobile industry produced 777,000 trucks in 1940,[6] some fear that any curtailment will jeopardize commercial transportation. Part of existing productive capacity is being utilized to make vehicles for the armed forces and, in a war emergency, the Army may also requisition many existing trucks. Motor carriers, who are now experiencing a rapid growth in traffic,[7] have virtually no surplus equipment, and some are reporting delays in getting new trucks and trailers.[8] Since the railways probably cannot handle all the increased traffic resulting from the defense program, the trucking industry will have to be kept in condition to shoulder part of the burden.

WATER TRANSPORTATION

Inland waterways are also capable of carrying a larger volume of traffic than in the last war. The mileage of navigable channels has been considerably extended, and the capacity of cargo-carriers has also increased.[9] In 1939 inland waterways, including the Great Lakes, transported 553,858,762 net tons of freight.[10] The bulk of the iron ore needed by the iron and steel industry moves via the Great Lakes. Rivers and canals can probably handle some additional freight since their floating equipment—tugs and barges—has increased more than 64 per cent since 1929. Their utility is limited, however, because they are often not navigable for part of the year and much of their traffic is either originated or reshipped by rail. On the Great Lakes, ore-carrying vessels are now being used to capacity, so that legislation permitting Canadian ships to enter the traffic between American ports has proved necessary.[11] The plan to raise the capacity of the iron and steel industry by 10,000,000 tons will require the building of more Lake freighters.

Coastwise and intercoastal transportation has had to be greatly curtailed owing to the acute shortage of ocean-going ships. Many vessels engaged in domestic trade have been sold and transferred to foreign registry with the consent of the Maritime Commission. From the middle of 1939 to the end of March 1941 the tonnage of freighters and combination passenger and cargo vessels engaged in domestic trade declined by 15 per cent. Since March the government has called for the withdrawal of additional vessels to serve more essential foreign trade routes. The number of tankers in coastwise traffic actually increased up to the spring of 1941 because of the rapid growth in demand for

1. Automobile Manufacturers Association, *Motor Truck Facts 1940*, p. 26.

2. Interstate Commerce Carriers, Bureau of Motor Carriers, *Road Facilities and Vehicles Used in Highway Transport*, August 1940, p. 8.

3. "The U.S. Highway System," *Fortune* (New York), June 1941.

4. Testimony of T. H. MacDonald, Commissioner, Public Roads Administration, House of Representatives, 77th Congress, 1st session, *Hearings before the Subcommittee of the Committee on Appropriations on the Independent Offices Appropriation Bill for 1942*, p. 249.

5. *Congressional Record*, June 2, 1941, p. 4694. In a bill approved on June 16, the Senate authorized the expenditure of $250,000,000. *The New York Times*, June 17, 1941.

6. *Automobile Facts*, February 1941, p. 6.

7. Reports of the American Trucking Association indicate that motor freight during January, February and March 1941 was 10, 29 and 36 per cent in excess of 1940.

8. *Transport Topics*, April 1941.

9. National Association of Railroad and Utilities Commissioners, *Utility Regulation and National Defense* (2nd ed.; February 1941), p. 89. According to government data, the mileage of inland waterways at the beginning of 1939 totaled 27,406, of which 11,718 had a depth of 6 feet or more.

10. For data on freight carried by inland waterways, see *Waterborne Commerce of the U.S. for the Calendar year 1939, Report of the Chief of Engineers, 1940*, part 2.

11. This law (*Public No. 90*) was approved by the President on June 2, 1941. The Canadian vessels will increase ore-carrying capacity from 75,000,000 to 76,500,000 long tons per year.

oil on the Atlantic seaboard. Recently, however, 50 tankers, or about one-sixth of the total, have been withdrawn for the purpose of aiding Britain.

Certain factors limit the extent to which the domestic trade fleet can be depleted. This fleet handles primarily low-priced, bulky freight. In the intercoastal (Pacific-Atlantic) trade, vessels carry lumber,[12] petroleum, wheat and wheat flour, sugar, iron and steel, paper stocks, etc. In the coastwise trades about 70 per cent of the traffic consists of petroleum, the balance of coal, sulphur, phosphates, etc.[13] To transport many of these commodities by rail would involve substantial increases in cost. Moreover, in a number of cases shippers or consumers have no rail facilities for the dispatch or receipt of such bulky materials. This is largely true, for example, of the lumber industry on the West Coast, many paper mills in the South, and certain large coal consumers, particularly power plants, in New England. Some experts also question the advisability of diverting water-borne trade to the railroads when the latter may have difficulty coping with their own traffic load. In 1939, however, the total volume of dry cargo transported in the coastwise and intercoastal trades—about 44 million net tons—amounted to but 4.6 per cent of the tonnage carried by the railways. If all traffic had been handled by rail, it would have added much less than 4.6 per cent to railway carloadings, for a large part of water-borne cargo first moves to ports by rail and is reshipped by rail on reaching ports of destination. Present plans probably do not contemplate taking more than 40 per cent of the tonnage out of domestic trade.[14] It is therefore unlikely that the ensuing diversion of dry cargoes would add much more than 1 to 1½ per cent to railway carloadings.[15]

On the other hand, the railways do not have enough tank cars to transport the petroleum and petroleum products that ordinarily move by water. In 1939 coastwise tankers carried 106,761,000 net tons of petroleum and its products, as compared with 60,057,437 tons transported by rail.[16] The eastern seaboard has been getting about 96 per cent of its consumption by water, relying on about 250 tankers for supplies from the Gulf Coast and on 40 to 50 for oil and gasoline from the Dutch West Indies, Mexico and South America.[17] Now that 50 tankers have been withdrawn, and many more required for aid to Britain, a shortage of petroleum products threatens in the Atlantic states. The Maritime Commission has ordered 72 more tankers, but none will be completed before late this year or early in 1942, and all or most of them may by that time be required to replace tankers sunk in British service. While the railways have enough surplus tank cars to replace 50 tankers, many of the refineries on the Atlantic coast do not have the facilities to receive shipments by rail.

PIPE LINES

The eastern seaboard will consequently have to rely more heavily on pipe lines. Until recently existing pipe lines, which had continued to expand from 106,650 miles in 1929 to 126,400 miles at the end of 1940, were considered quite adequate.[18-19] In the present emergency, however, the capacity of the few pipe lines which can supply eastern refineries is far from sufficient. Additional lines must be built from the Gulf Coast and Texas to the Atlantic. Construction can take place rapidly, provided the necessary rights-of-way can be secured from the railroads and state governments. The President has urged Congress to enact a bill[20] authorizing him to provide for the construction of any interstate pipe line needed for national defense, and to empower private or governmental agencies to acquire rights-of-way for such pipe lines through condemnation. The Plantation Pipe Line Company has already ordered the pipe necessary to lay a gasoline line from Baton Rouge, La., to Greensboro, N.C.[21] Oil companies are projecting two more pipe lines from Texas to New York City and the Jersey coast, which could be built in 12 to 15 months.[22] These three lines would take the place of about 140 tankers.[23] Pending their completion, however, the East may suffer from a

12. Lumber accounted for 30 to 34 per cent of the east-bound traffic in the years 1936 to 1939, and for 48 per cent in 1940. U.S. Maritime Commission, *Press Release 810,* January 21, 1941.

13. See U.S. Maritime Commission, *Economic Survey of Coastwise and Intercoastal Shipping* (Washington 1939).

14. On June 4 it was reported that the Maritime Commission had ordered Atlantic and Gulf coastwise steamship lines to surrender half of their tonnage. Subsequently, however, this proportion appears to have been reduced to half of those ships with a deadweight tonnage of 3,500 and over. Not more than 60 or 62 vessels out of a total of 125 were said to be included in this category. *The New York Times,* June 5, 9, 1941.

15. According to a study by the Association of American Railroads, the demand for railway-car space would be only 2½ per cent higher if all traffic through the Panama Canal, including domestic as well as international trade, were diverted to the railways. *Ibid.,* June 9, 1941.

16. American Petroleum Institute, *Petroleum Facts and Figures, 1941* (7th ed.) pp. 138, 141.

17. Speech of Dr. Robert E. Wilson, chief petroleum consultant of the OPM, May 20, 1941, *OPM Press Release PM 414.*

18-19. *Petroleum Facts and Figures, 1941,* cited, p. 124.

20. *H.R. 4816.*

21. *Ibid.,* May 22, 1941. Construction of this pipe line has been held up owing to the refusal of the railways to grant rights-of-way, and the failure of Georgia and South Carolina to pass legislation permitting condemnation.

22. See the extracts of a report to the OPM and Secretary Ickes, Petroleum Coordinator for National Defense, in *The New York Times,* June 4, 1941.

23. *Ibid.*

shortage of oil and gasoline requiring curtailment of nonessential consumption.

THE RAILWAYS

The railroads are still the most important transport agency in the country, handling nearly two-thirds of inter-city freight. It is therefore of vital importance that the railways be capable of carrying the increased traffic resulting from the national defense program. In the last war the railways became so congested that a major transportation crisis arose. The railways were not equipped to deal with the heavy eastward movement of freight for export. Spiraling costs of materials and labor made them financially unable to add greatly to their equipment and facilities. The shortage of rolling stock was aggravated through indiscriminate and uncoordinated use of priorities by a number of government agencies. Cars were loaded and dispatched without considering the availability of unloading facilities at points of destination. Goods awaiting shipment abroad at eastern ports piled up on piers and in warehouses and terminals. Cars were used for storage instead of transportation. Freight yards in the east as far from the coast as Detroit and Columbus were clogged with cars that could not be delivered. After the government took over the railways in December 1917, conditions gradually improved. While some transportation authorities have attributed this improvement to the fact that the roads were operated for the first time as a single unit without regard to ownership,[24] railway spokesmen have maintained that the elimination of congestion was due primarily, if not solely, to coordinated use of priorities, rather than government operation.

Those who fear a similar crisis in the current war can point to certain evidence that the plant and equipment of the railroads have deteriorated during the last decade. Railway income dropped sharply due to the prolonged economic depression and the diversion of business to competing carriers.[25] Many companies were forced into bankruptcy and receivership,[26] and few had sufficient income for maintenance and new equipment. During the decade 1931 to 1940 the gross expenditures of Class I Railways[27] for improvements and additions to equipment, roadway and structures averaged only one-third the amount spent yearly in the period 1923 to 1930. Maintenance expenditures averaged 44 per cent less, but were probably not far short of needs owing to lower costs of maintenance work, reduced depreciation because of smaller traffic, and advances made in lengthening the life of materials.[28]

DETERIORATION OF ROLLING STOCK

Under these circumstances, the amount of railway rolling stock has declined and obsolescence of available equipment has increased. In 1940 68.5 per cent of the steam locomotives of Class I Railways were over 20 years old, and 47.5 per cent more than 25 years of age.[29] Of the freight cars owned by these railways on January 1, 1941, 41.1 per cent were over 20, and 25.2 per cent over 25 years old.[30] To some extent these figures must be discounted because old equipment is not necessarily unserviceable and part of it has been rebuilt and modernized. Nevertheless, old cars and locomotives are, in most cases, not as efficient as new ones and require heavier repairs under continuous usage.

The number of freight cars owned by Class I Railways declined from 2,325,562 at the end of 1918 to 2,297,548 at the close of 1929, and thereafter fell sharply to 1,640,799 on December 31, 1940[31]—a total drop of over 29 per cent. During the same period the locomotive inventory was reduced from about 63,500 units to 57,900, and then to approximately 41,000 at the end of 1940—in all a decline of over 35 per cent.

These statistics, however, present too pessimistic a picture. The decline in rolling stock has been partly offset by an increase in the average capacity of freight cars and the power and speed of locomotives. If these factors are taken into account, the aggregate capacity of freight cars owned by Class I Railroads at the end of 1940 was only 22 per cent smaller than in 1929, and 15 per cent less than in 1918; and the total tractive power of locomotives was 18.5 per cent below 1929, and slightly over 5 per cent below 1918.

24. See Emory R. Johnson and Thurman W. Van Metre, *Principles of Railroad Transportation* (New York, Appleton, 1922), pp. 504-507; also Kent T. Healy, *The Economics of Transportation in America* (New York, Ronald Press, 1940), p. 17.

25. In 1940 the total volume of commodities moving from producer to consumer had recovered to 92 per cent of the 1928 level; but the railways handled only 78 per cent of their 1928 traffic. Julius H. Parmalee, *A Review of Railway Operations in 1940* (Washington, Bureau of Railway Economics, Association of American Railroads, 1941), p. 12.

26. Despite the improvement in net income in the last few years, 31 per cent of the country's railway mileage was still in receivership or trusteeship at the end of 1940. *Ibid.*, pp. 9-10.

27. I.e., railways with annual operating revenues in excess of $1,000,000.

28. At the beginning of 1941, however, one expert expressed the opinion that "the accrued deficiency in maintenance is still large." Neal D. Howard, "Construction and Maintenance Must Improve to Keep Pace," *Railway Age*, January 4, 1941.

29. H. C. Wilcox, "Reduced Locomotive Inventory is Affecting Capacity," *Railway Age*, January 4, 1941. Steam locomotives accounted in 1940 for more than 96 per cent of the motive power inventory of Class I Railways.

30. American Railway Car Institute, *Statistics, Car Building and Car Repairing 1940*, p. 42.

31. *Ibid.*, p. 8.

IMPROVEMENTS IN OPERATING EFFICIENCY

Despite the apparent decrease in carrying power, the railways managed to handle more freight traffic during the first quarter of 1941 than in the corresponding period of 1917 or 1918.[32] They have been able to accomplish this only because of the progress in operating efficiency since the last war. More powerful locomotives make possible longer freight trains and greater speed. Improvements in trackage, roadbeds, signaling devices and freight-handling have also expedited operations. The railroads themselves have provided more centralized and efficient direction of traffic through the Car Service Division of the Association of American Railroads. This division helps in mobilizing and distributing cars to handle large freight movements; it can order the transfer of cars from one territory or railroad to another, if necessary to meet traffic requirements; and watches over the imposition of embargoes designed to forestall congestion.[33] The cooperation of the 13 regional Shippers' Advisory Boards set up in 1923 has helped the division in forecasting the demand for freight cars, and facilitated more rapid loading and unloading.[34]

In October 1939, shortly after the outbreak of war, the A.A.R. also established a Port Traffic Section for the purpose of preventing conditions of congestion similar to those in the last war. Through its local representatives this section keeps a constant check on the number of loaded and empty cars on hand, and the railway storage space available at every principal port. At the first sign of congestion an embargo prohibiting shipments to the affected port except against special permits can be applied. Up to the present, only one temporary embargo has been necessary, and North Atlantic ports have in some cases handled traffic approaching or exceeding 1918 peaks without undue detention of loaded cars or overcrowding of terminals.[35] Improvement in port facilities and expansion of warehousing capacity[36] have also helped to prevent congestion.

32. According to the Association of American Railroads, total freight ton-miles (revenue and non-revenue freight) were 16.6 and 18.3 per cent higher than in 1917 and 1918, respectively.

33. M. J. Gormley, *Railway Capacity and Traffic Control* (Association of American Railroads, November 1939), pp. 41-42.

34. L. M. Betts, "The Shippers' Advisory Board Movement," *The Journal of Business*, February 1941.

35. See statement by Ralph Budd, chief of the Transportation Division of the National Defense Advisory Commission, *Defense*, February 4, 1941, p. 5.

36. In a speech delivered on February 5, 1941 Frank C. Ferguson, chairman of the Port of New York Authority, pointed out that 20 miles of new steamship berthage had been added in New York port since 1918, and that terminal warehouse space for export-import freight had increased 20 per cent over 1917. According to the Bureau of Census, merchandise warehouses showed an occupancy rate of only 77.2 per cent on March 1, 1941 (*Defense*, May 6, 1941). The Transportation Division of the Defense Commission has reported that ample warehouse space is available and that no construction is necessary. The capacity of private grain elevators, however, is inadequate (*ibid.*, April 22, p. 21).

The increased speed and efficiency with which the railways are handling and moving freight traffic is shown by the following figures:

	1920	*1930*	*1940*
Net ton-miles per freight-train hour[1]	7,303	10,836	14,027
Freight-train speed (miles per hour)[2]	10.3	13.8	16.7
Miles per active freight-car day[3]	27.2	38.6	42.6
Miles per active locomotive day[4]	85.3	89.6	107.2

1. Total tonnage of freight during one hour by freight trains on the road.
2. Includes delays en route.
3. Average number of miles traveled per day by active freight cars, including time spent loading and unloading.
4. Daily mileage per active locomotive.

During the last two decades the hourly ton-mileage of freight trains on the road has risen over 92 per cent, and the average daily mileage of active freight cars has increased 56 per cent.

ANTICIPATED TRAFFIC LOAD

Whether the available railway equipment will continue to be adequate depends, of course, on the volume of freight to be handled. Until recently railway spokesmen, defense officials and shippers have all greatly underestimated the increase in traffic expected under the defense program. Opinions that equipment would be sufficient because the "defense" or "war" load would at the most amount to but 8 to 12 per cent of the "normal commercial load"[37] have proved wide of the mark. They did not anticipate the expansion of defense requirements and failed to take into account the general stimulus imparted by the defense program to industrial and commercial activity. During the first quarter of 1941 carloadings were 14.8 per cent higher than in the same period of 1940; during April they would have been about 26 per cent above 1940 had it not been for the coal strike; and in May they were almost 24 per cent greater. At the beginning of 1941 the Association of American Railroads predicted, on the basis of data furnished by defense officials, that 1941 carloadings would be 9.4 per cent and 1942 carloadings 16.9

37. See the estimates made by M. J. Gormley, executive assistant, Association of American Railroads, in *Railway Capacity and Control*, cited; and a speech delivered on July 25, 1940 before the Northwest Shippers' Advisory Board on *The Railroads' Relationship to National Defense*.

per cent higher than in 1940.[38] According to revised estimates made public by the A.A.R. on May 1, 1941,[39] traffic may be expected to develop as follows:

Year	No. of Carloadings (in 1,000's)
1938	30,457
1939	33,911
1940	36,351
1941 (est.)	40,899
1942 (est.)	43,680
1943 (est.)	48,048

Even this forecast may prove too conservative, at least for 1941. One authority, for example, anticipates that traffic during the second half of the current year may be 25 per cent greater than in 1940.[40] To railway operators this estimate appears much too high because carloadings in the second half of 1940 showed a sharp rise over the first half of that year. Moreover, the rate of increase evident in recent months cannot be expected to continue indefinitely because, in time, further expansion of defense production will be possible only at the expense of non-defense output.

The railways would have little difficulty meeting the anticipated traffic if it were distributed evenly over the year. Freight movements, however, are highly seasonal, with peak requirements falling in the eight weeks between mid-September and mid-November. The traffic peak is hard to estimate in advance. In 1940, for instance, total revenue carloadings were 7.2 per cent more than in 1939, but the peak loading attained during any week was actually 2.2 per cent lower than that reached in 1939.[41] Predictions concerning the highest weekly carloadings to be expected this fall range from 940,000 (A.A.R.) to 1,050,000 (*Railway Age*[42]), or from 13.4 to 25 per cent higher than in 1940.

FREIGHT CAR SUPPLY

Will the railroads have enough cars to handle this traffic peak? On April 15, 1941 they owned 1,619,101 cars, of which 99,597, or 6.2 per cent, were unserviceable—i.e., awaiting or undergoing repairs. In addition, they had on line 212,909 cars owned by private shippers, of which 1,438, or 0.7 per cent, were unserviceable.[43] Mr. Budd, the head of the Transportation Division of the Office of Emergency Management, hopes that the delivery of new rolling stock will bring railway car ownership up to 1,700,000 by the fall peak, and that the number of serviceable cars can be lifted to 1,615,000 by reducing the proportion under repair to 5 per cent.[44] With the addition of privately owned cars, about 1,827,000 serviceable cars would be on hand. For efficient operation, a minimum reserve of 50,000 cars must be kept available for transfer to points where shortages may occur, thus leaving a net total of about 1,777,000. With this number of cars, the railways could attain a peak loading of 987,569 cars per week, provided they equalled their previous record of one weekly carloading per 1.85 serviceable cars.[45] This figure indicates that railway capacity may be overtaxed during the 1941 traffic peak, or will at best be barely sufficient.

NEED FOR MORE ROLLING STOCK

The A.A.R. has estimated that the railways will need 120,000 more cars to handle the anticipated freight volume in 1942, and another 150,000 to meet needs in 1943.[46] Replacement requirements probably can be reduced to 40,000 cars per year,[47] so that the total number of new cars needed will amount to 160,000 and 190,000, respectively. Although the railways have expressed a willingness to add the needed cars, there is some doubt about the ability of the railway equipment industry to supply them. In the last decade the largest number of cars built in any one year was 77,498;[48] and in 1941 output will probably reach not more than 100,000. It has been estimated that commercial car builders could turn out 150,000 cars per year, and the railways' own shops an additional 30,000.[49] Such capacity figures can be attained, however, only if railways place orders in units of at least 1,000 cars of each type, and if sufficient labor and steel can be obtained. Car builders may be unable to recruit enough skilled labor and supervisory personnel in view of the competition of defense industries for the available supply. Lack of steel has also reduced their output, although this difficulty has apparently been surmounted with the promulgation on June 9 of a Civilian Allocation Program which will give material for rolling stock

38. *Defense*, March 11, 1941, p. 16.

39. Association of American Railroads, *Press Release 1744*, May 1, 1941.

40. *Railway Age*, May 10, 1941, p. 789.

41. Parmalee, *A Review of Railway Operations in 1940*, cited, p. 22.

42. Issue of May 10, 1941, p. 789.

43. Association of American Railroads, *Semi-Monthly Statement of Revenue Freight Cars Awaiting Repairs and Class I Railroads*, April 15, 1941.

44. *Defense*, June 3, 1941.

45. For a somewhat similar calculation, see *Railway Age*, May 10, 1941, p. 790.

46. *Press Release*, May 1, 1941.

47. During the last five years freight car retirements have actually averaged 93,785. *Statistics, Car Building and Car Repairing 1940*, cited, p. 4.

48. *Ibid.*

49. *Railway Age* (May 17, 1941, p. 857) puts the capacity of railway shops at 60,000, but this appears to be an overestimate.

priority over other civilian requirements.[50] Nevertheless, the railway equipment industry is likely to be hard pressed if orders for the required number of cars are actually placed.

IMPROVED UTILIZATION OF EXISTING EQUIPMENT

Under these conditions, great stress must be placed on securing better utilization of available rolling stock. Additional cars would be released if shippers and receivers cooperated in expediting loading and unloading and if industries working a five-day week would put loading and unloading operations on at least a six-day basis.[51] An even greater saving would be effected if shippers would load cars more heavily.[52] More even distribution of freight movements over the entire year would also help railroads to cope with traffic peaks.[53] To this end it has been suggested that industrial and household consumers buy their coal supplies in early summer, and that business men make shipments and build up inventories as far as practicable at times other than during the fall traffic peak.[54]

NEED FOR BETTER FREIGHT YARDS

Substantial improvement in freight yards and terminals would also contribute to railway operating efficiency. Terminal yards have been called "the graveyards of cars."[55] A study in 1933 revealed that 144 hours elapsed on the average between the time a car was put at the disposal of the shipper for loading and the time it was released by the consignee. Of this total, 68 hours were spent loading and unloading, 23 hours in actual road movement, and 53 hours in various freight yards.[56] Freight terminals are, on the whole, a weak link in railway operation. They have grown rather haphazardly, often to the detriment of efficiency.[57] In but relatively few cases have terminals been designed for effective joint use by several roads, and this excessive individualism on the part of railway companies "causes extra car handling and often unduly long car movements within terminals."[58]

While a number of new terminals have been built since the last war, and considerable improvement effected in others, the development of freight yards has not kept pace with other railway betterments. Early in 1940 the *Railway Age* wrote:[59] ". . . yard facilities at terminals and intermediate points, in general, comprise one of the most serious obstacles to expedited freight train service. While many improvements have been made in equipment, and especially in power, to keep freight moving over the line, inadequate revenues have made it impossible to bring about those changes at many yards and terminals which are conducive, if not essential, to the expeditious handling of cars at these points, comparable with the expedited road movements and the still greater road-haul speeds which are contemplated." One year later the same publication again emphasized the necessity for "numerous changes at yards and terminals to expedite handling of cars at these points."[60]

While modernization of relatively backward terminals would take time, operators could probably bring about immediate and considerable improvement in efficiency through closer and more intensive supervision over the movement and disposition of cars within freight yards. Another remedy open to the railways is to permit joint use of each other's terminal trackage, structures and facilities.

GOVERNMENT OPERATION?

Doubts concerning the railways' ability to cope with the transportation problem have raised once more the possibility that the government might take over the task of operation, just as in the last war. Advocates of such a step argue that it would insure much greater efficiency by consolidating existing railroads and eliminating wasteful compe-

50. *Defense,* June 17, 1941, p. 14. The 1941 steel needs of car builders have been estimated by the A.A.R. at 1,497,514 tons (*Railway Age,* May 10, 1941, pp. 302-303), but requirements in each of the next two years will probably exceed 2,500,000 tons.

51. See the recommendations of the National Defense Advisory Commission, *Defense,* May 6, 1941, p. 20.

52. The degree of improvement attainable in this respect is illustrated by the fact that the average tonnage carried by a loaded car in 1940 amounted to only 55.5 per cent of capacity, as compared with a record of 70.5 per cent set in 1918. These percentages are calculated from figures in *Statistics, Car Building and Car Repairing, 1940,* cited, pp. 8, 21.

53. In the 20-year period 1918-1939, the highest weekly car loadings have averaged 18 per cent in excess of the annual average.

54. Speech of W. A. Harriman, *OPM Press Release PM 71,* February 13, 1941.

55. L. F. Loree, *Railroad Freight and Transportation* (2nd ed.; New York, Appleton, 1931), p. 34.

56. Federal Coordinator of Transportation, *Freight Traffic Report* (Washington, 1935), Vol. II, p. 7.

57. John A. Droege, *Freight Terminals and Trains* (2nd ed.; New York, McGraw-Hill, 1925), p. 9; also H. Moulton and associates, *The American Transportation Problem* (Washington, The Brookings Institution, 1933), pp. 786, 789.

58. Moulton, *The American Transportation Problem,* cited, p. 790.

59. Issue of January 6, 1940, p. 23.

60. In particular, it declared "there is widespread need for revised yard layouts, revised humps and car retarder installations, power-operated switches, floodlights for safer and more expeditious night operation, and modern communication and messenger service." Howard, "Construction and Maintenance Must Improve to Keep Pace," cited.

tition, by unifying terminal properties, and by coordinating the railways more effectively with other transport agencies. The railway companies refuse to admit the validity of these arguments. Although Joseph B. Eastman, chairman of the Interstate Commerce Commission, has denied the existence of any plans for government operation, he has stressed the paramount importance of transportation to national defense and war operations, and has warned the railroads that "if any defaults or deficiencies develop, I imagine that the government will not long hesitate to assume control if by so doing it can see a way of correcting or averting dangerous conditions."[61]

In contrast to the last war, the government has broad powers which permit it to exercise extensive control over the railways short of actually operating them. If the Interstate Commerce Commission finds that a shortage of equipment, congestion of traffic or other emergency requiring action exists in any part of the country, it may suspend the operation of any or all rules regarding car service, issue its own directions with respect to car movement without regard to ownership, and require the pooling of terminal facilities. In addition, it is authorized to accord preference or priority ratings to shipments "in time of war or threatened war" provided the President certifies that such action is necessary to national defense.[62] These powers may prove sufficient for any emergency.

ELECTRIC POWER AND DEFENSE

In the first World War power shortages, caused largely by lack of fuel, hampered defense production in certain areas.[63] Since that time electricity as a source of light and power has become a far more vital factor in our economy. In 1939 electric motors accounted for 86.3 per cent of the power equipment in American factories.[64] In the period 1920 to 1940 the capacity of plants generating power for public use almost tripled, rising from 14,372,009 to 41,638,956 kilowatts.[65] Their output increased even more, from 43,334,282,000 kilowatt hours in 1920 to 144,984,565,000 in 1940.[66] Private utilities contributed 86.5 per cent of the supply last year, and owned 82.6 per cent of the generating capacity at the end of 1940. Steam plants accounted for almost 70 per cent of capacity and 66 per cent of production in 1940, while water power plants generated 31.5 per cent of the electricity and owned 28 per cent of the capacity.[67]

GENERATING CAPACITY AND OUTPUT OF ALL PLANTS CONTRIBUTING TO THE PUBLIC SUPPLY*

Year	Capacity at End of Year (kilowatts)	Production (1,000 kilowatt hours)
1920	14,372,009	43,334,282
1930	34,055,319	94,651,597
1935	36,074,442	98,464,073
1940	41,638,956	144,984,565

The Electric Light and Power Industry in the United States, Year 1940, cited, pp. 5, 10.

From 1920 to 1930 generating capacity expanded more rapidly than total energy output. In the ensuing five years of depression little new equipment was installed, but the demand for power declined simultaneously. After 1935 the private utilities gradually increased construction programs, although fear of government regulation and competition retarded expansion to some extent. From 1935 to 1940 the capacity of private utilities rose by 2,578,219 kilowatts, or about 8 per cent, and that of government and municipal plants by 2,476,763 kilowatts, or 116 per cent.[68] Through its own hydroelectric development program the government created a power surplus in certain areas which has since been taken up by new defense industries.

During 1941 and 1942 a record total of about 7,000,000 kilowatts is scheduled for installation.

PROJECTED INCREASE IN GENERATING CAPACITY IN KILOWATTS*

Ownership	1941	1942
Private	2,260,000	2,000,000
Municipal	370,000	200,000
Governmental	890,000	1,200,000
TOTAL	3,520,000	3,400,000

The Electric Light and Power Industry in the United States, Year 1940, cited, p. 6. The totals exclude capacity to be added by industry.

By the beginning of June, orders for new generating equipment in 1942 and 1943 totaled 1,046,000 and 668,000 kilowatts, respectively.[69] The completion of this program will depend on the ability of industry to meet deliveries, particularly on steam turbines, which are needed for about two-

61. *New York Herald Tribune*, May 8, 1941.

62. For a summary of these powers, see *53rd Annual Report of the Interstate Commerce Commission*, November 1, 1939, pp. 21-24.

63. See Col. Charles Keller, *The Power Situation during the War* (Washington, Government Printing Office, 1921).

64. According to census figures, industry at the end of 1939 had 46,000,000 horsepower of electric motors, and 21,267,000 horsepower of non-electrical prime-movers. Of the latter, however, two-thirds were used to generate electric power for plant use. *Power*, May 1941, p. 94.

65. Edison Electric Institute, *The Electric Light and Power Industry in the United States, Year 1940*, p. 5.

66. *Ibid.*, p. 10.

67. Internal combustion engines accounted for the remainder. *Ibid.*, pp. 5, 10.

68. *Ibid.*, p. 5.

69. See the address of Charles W. Kellogg before the first general session of the Ninth Annual Convention of the Edison Electric Institute, June 3, 1941.

thirds of the contemplated additional capacity. The few plants which build such turbines must also cope with large contracts for propulsion machinery for naval vessels. Up to the present, their work has been very nearly on schedule, although they may be unable to carry out additional orders without delay. In April 1941 a subcommittee was formed in the Priorities Section of the OPM to deal with questions concerning preference ratings for power-plant equipment.[70]

RESERVE CAPACITY

In assessing the ability of the power industry to meet future needs, one must take into account not only the scheduled increase in capacity, but also the excess capacity which has been available up to the present. Excess capacity must be measured against peak power requirements. The demand for electricity fluctuates widely, the power "load" varying during both the day and the year. Since electrical energy cannot be stored, generating capacity must be sufficient to meet peak demand. For most generating systems, the yearly peak occurs sometime during December. In 1940 the sum of all generating peaks amounted to about 31,800,000 kilowatts, as compared with an installed capacity of 41,638,956. Thus power plants were, at least in theory, capable of a peak output 30.9 per cent greater. Whether excess capacity was actually as great as that is a matter of dispute. In calculating capacity, allowance must be made for maintenance of equipment, emergency breakdowns, limitations of boiler or condenser capacity and transmission facilities and, in the case of hydro plants, insufficient stream flow. In December 1940 Class I utility systems reported that their "dependable capacity," estimated according to criteria laid down by the Federal Power Commission, was in the aggregate 8 per cent below installed capacity. In addition, they put required reserves at 12.4 per cent.[71] Utility spokesmen claim, however, that the estimate of "dependable capacity" is extremely conservative and that a considerable percentage of "required reserves" can be used. Thus Mr. Charles W. Kellogg, president of the Edison Electric Institute, believes that there is still a generating margin of 10 to 15 per cent available. He has pointed out, too, that steam generating stations are generally built for an "overload" and can therefore exceed rated capacities by 10 to 15 per cent during a peak of moderate duration. The same is true of hydro generators, provided water conditions are favorable.[72] According to these calculations, therefore, the utilities as a whole are capable of meeting a peak load 20 to 30 per cent above the 1940 level without additional equipment. This does not mean, of course, that every system has such a reserve. Some have considerable, others comparatively little, excess capacity; and surpluses cannot be transferred from one system to another unless the systems are interconnected.

SHORTAGES PREDICTED

While the private utility companies are generally confident that existing excess capacity and scheduled increases will be sufficient to prevent serious power shortages, the Federal Power Commission is much more pessimistic. Its last survey, published early in June 1941, warned that "many areas of the country are now actually facing power shortages which can be met only by cutting into essential reserves, by bringing in power to the extent permitted by transmission interconnections from other areas, or by curtailing actual or potential loads."[73] The Commission also expressed the belief that equipment installations in 1941 and 1942 might fall 1,400,000 kilowatts short of needs, and predicted that "unless orders are placed immediately for large amounts of additional capacity for 1943, serious shortages will develop in that year, and in subsequent years if the emergency continues."

These findings are based on lower estimates of capacity and higher estimates of future demand than the private utilities have made. With the rapid expansion of the defense program, requirements for electric power are undoubtedly rising much more rapidly than was originally anticipated. For example, if plans to expand aluminum capacity from 800 to 1,600 million pounds a year are carried out, this alone would demand electric generating capacity of at least 1,000,000 kilowatts.[74] According to Leland Olds, chairman of the Federal Power Commission, more than 10,000,000 kilowatts of additional capacity will be needed within the next few years, on the assumption that the defense program will put from 5 to 8 million persons to work and that modern industry requires an average of 2 kilowatts per worker.[75]

The utilities will have to supply most of the

70. *Electrical World*, April 19, 1941, p. 68.

71. Total installed capacity was reported at 36,018,494 kw.; dependable capacity at 33,145,330 kw.; and required reserve at 4,467,443 kw. Federal Power Commission, National Defense Power Survey, *Electric Power Requirements and Supply in the United States, December 1940* (Washington, 1941).

72. See Mr. Kellogg's speech of June 3, 1941, cited. Mr. Kellogg's contention is supported by the fact that the peak of 20 utility companies in 1940 ranged from 100 to 123.2 per cent of installed capacity. "Annual Peak Load Survey Reaffirms Utility Preparedness," *Electrical World*, May 3, 1941.

73. Federal Power Commission, National Defense Power Survey, *Electric Power Requirements and Supply in the United States, March 1941* (Washington, 1941).

74. *The New York Times*, June 14, 1941.

75. See his statement, published in the *Atlanta Constitution*, June 5, 1941.

power needed for national defense because industrial plants, which have in the past satisfied all or part of their own power needs, will probably have to rely in increasing measure on purchased power. According to census figures, manufacturing establishments supplied almost 40 per cent of their electrical power requirements in 1939. They purchased 45 billion kilowatt hours and produced 29 billion kilowatt hours, but had a generating reserve of less than 10 per cent.[76] Although industrial plants added 250,000 kilowatts of generating facilities in 1940 and plan to install 600,000 kilowatts more in the current year,[77] it is doubtful that their capacity can keep pace with needs.

In estimating this country's possible power requirements, however, one must remember that peak demand will not rise as rapidly as total energy output. Through lengthening of hours and the inauguration of multiple shifts in industry, the demand for power has been more evenly distributed over the day than previously. While total power output in 1940 was 11.2 per cent higher than in 1939, the aggregate peaks were only 7.4 per cent greater. In the current year the increase in peak loads continues to lag behind output.[78]

The only actual power shortage at present is in the southeast, where demand for power by aluminum and other defense plants has risen rapidly and where an extraordinary drought has reduced the output of the TVA system about 40 per cent. Private utilities, which rely primarily on steam plants, have had to come to the rescue of the TVA; and, beginning June 16, power for non-essential industries has been rationed.[79] Such power shortages as may develop in other areas, owing to unprecedented demands for national defense and unrestricted demand for civilian uses, can be met in three ways: (1) further expansion of generating facilities; (2) increased interconnection between power systems; and (3) rationing.

1. Expansion of capacity. The Federal Power Commission has been holding regional conferences to bring about expansion of power output on a cooperative basis. Congress has been asked for additional funds for federal hydroelectric development—to speed completion of the Central Valley project in California, and to provide additional generating capacity in the TVA area and at the Boulder, Bonneville and Grand Coulee dams. On June 5 the President requested Congress to authorize construction of the Great Lakes-St. Lawrence seaway and power project, in accordance with an executive agreement signed with Canada on March 19, 1941.[80] Under this accord, a dam capable of developing 2,200,000 horsepower, or 1,641,200 kilowatts, would be built near Massena, N. Y. Half of the output would be available to the United States, thus adding ultimately about 42 per cent to the installed generating capacity of upstate New York as of December 1940. The government estimates that completion of the dam would require 3½ years under normal circumstances, but might be speeded in the emergency.[81] Even under the best conditions, however, it would not relieve any power shortage which might develop by the end of 1941, 1942 or 1943. More rapid, although only partial, relief will be provided by an agreement, ratified by the Senate on June 13, which permits the diversion of more water from the Niagara river for existing generators.[82] Opponents of the St. Lawrence project claim that the erection of steam power plants could supply the needed power within half the time and at much smaller initial cost.[83] This argument assumes, however, that orders for additional steam turbines could be filled without great difficulty. The private utility interests would, in general, prefer to be entrusted with the responsibility of providing such additional capacity as is needed, on condition that the federal government permits tax-free amortization of new equipment within a five-year period.

2. Increased interconnection. If adjacent power systems are connected by transmission lines, it becomes possible for one to utilize the surplus capacity of the other. Even if capacity of the interconnected systems are fully utilized, the time of their peak loads may not coincide, thus permitting them to draw on each other for the purpose of meeting peak requirements. Interconnection by high-voltage lines of 110,000 volts and over has made considerable progress since the first World War. The mileage of such lines rose from 2,890 in 1918 to 32,132 in 1938.[84] The total length of transmission lines of 33,000 volts and over increased from 88,977 miles in 1926 to 147,054 in 1939.[85] Nevertheless, there

76. See editorial in *Electrical World,* April 19, 1941; also *Power,* May 1941, cited, p. 3.

77. *The Electric Light and Power Industry in the United States, Year 1940,* cited, p. 3.

78. According to the Edison Electric Institute, composite peak loads and total output have developed as follows during the first four months of 1941, as compared with corresponding months of the preceding year (in percentage increases):

1941	*Peak Load*	*Total Output*
January	+ 9.0	+11.8
February	+10.5	+15.4
March	+11.7	+17.1
April	+11.8	+15.8

79. *New York Herald Tribune,* June 9, 1941.

80. For the text of the agreement, see *Department of State Bulletin,* March 22, 1941.

81. Address by Assistant Secretary of State, Adolf A. Berle, *ibid.,* p. 1.

82. *New York Herald Tribune,* June 14, 1941. The agreement provides for an additional diversion of 5,000 cubic feet a second, which adds about 56,769 kilowatts to generating capacity.

83. The entire cost of the St. Lawrence project has been estimated at $266,170,000, of which $38,578,000 would be solely for power, $96,804,000 primarily for navigation, and $130,788,000 for works common to both. The share of the United States and New York state would be $207,000,000.

84. U.S. Chamber of Commerce, *Power Capacity to Meet National Needs* (Washington, D.C., December 1939), p. 10. Mileage increased from 565 to 12,499 in the industrial part of the country—i.e., in the region east of the Mississippi, except for St. Louis, and north of the Kentucky-Tennessee state line.

85. *The Electric Light and Power Industry in the United States, Year 1940,* cited, p. 35.

are still important gaps in the network. According to federal power authorities, interconnection between New York City and upstate New York is inadequate, and there are no high-voltage transmission facilities between such important centers as New York City and New Jersey, Philadelphia and Pittsburgh, Buffalo and Cleveland, and Detroit and Toledo. The National Power Policy Committee, which was set up by the President in October 1939, has advanced a scheme for the formation of a giant "super-grid" which would link all the important industrial centers of the region east of the Mississippi and north of the Ohio.[86] The utilities maintain, however, that such a grid would have little advantage over existing interconnections.[87]

3. Rationing. Predictions of power shortages have been based on unlimited civilian, as well as defense, demand. Actually, nonessential power consumption can be greatly reduced. Residential and rural consumers, who accounted for over one-fifth of electricity sales in 1940,[88] may be rationed, and street, highway and store lighting curtailed. It has also been estimated that a 20 per cent reduction of strictly non-defense output would release more than 1,500,000 kilowatts for defense use.[89] In some cases, demand can also be shifted to non-peak periods.

CONCLUSION

Both our power industry and transportation system may prove inadequate to the extraordinary demands that will be imposed on them in the next few years. The extent to which they may fall short of requirements is disputed. It seems improbable, however, that the power shortage will be severe enough to hamper defense production seriously. Since the last war the power supply has generally kept pace with demand; and in the next two years a record volume of generating capacity is scheduled for installation. Nor are transportation facilities likely to become so congested that conditions approaching a breakdown will develop. The railways, which are supplemented much more extensively by other transport agencies than in 1917-18, will undoubtedly have to shoulder the major share of increased traffic during the emergency. Owing to the limited supply of rolling stock, the railroads may have difficulty in handling the freight volume anticipated this fall. Their future adequacy will depend largely on their ability to obtain delivery of the additional freight cars needed during the next few years.

It is important to bear in mind that predictions of shortages, for the most part, relate only to the ability of the railways and utilities to cope with peak loads, which fall in a relatively brief period each year. Nor do they generally take into account the possibility of curtailing non-defense demand for power and transportation. Private utilities can hardly be expected to maintain excess capacity sufficient to handle ordinary civilian business plus extraordinary defense requirements. If additions to their equipment are needed for purely emergency purposes, the power and transportation industries are probably entitled to the same financial assistance or amortization privileges as defense establishments. In the last analysis, however, the public must be prepared for sacrifices in order to give defense production first claim on available power and transportation facilities, if that should prove necessary.

In the present emergency both the railroads and power companies labor under the threat of government operation and ownership. The railways can best avoid government operation by clearly demonstrating their ability to handle the traffic, if necessary by effectively pooling their facilities and equipment. Government aid is needed, however, in coordinating the activities and development of all transport agencies. The chairman of the Interstate Commerce Commission has called for a permanent Department of Transportation, which "would issue no orders, but . . . would be in constant touch with the transportation situation, watching developments, noting trends, discovering opportunities for improvement, and foreseeing dangers ahead."[90]

Adjustment of problems of power supply is greatly complicated by the acrimonious relations which have long existed between the federal government and private utilities. The latter now suspect the government of deliberately exaggerating the prospect of power shortages in order to encroach further on private enterprise, while federal power authorities accuse the power companies of shortsightedness in opposing government regulation and hydroelectric development. Since neither can function effectively without the other, a more cooperative attitude and a determination to arrive at a mutual understanding appear essential. Continued conflict could only jeopardize the national defense effort.

86. *Wall Street Journal,* May 25, 1940.

87. "What Are the Power Shortage Facts?" *Electrical World,* June 14, 1941.

88. For a breakdown of sales by consumers, see *The Electric Light and Power Industry in the United States, Year 1940,* cited, p. 26.

89. *Wall Street Journal,* June 11, 1941.

90. Speech of April 23, 1941, as quoted in *Transport World,* April 26, 1941, p. 1032.